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of the river bed indicate an average of about one foot added overall to the elevation of the bed at the river's mouth in each twenty-year period, or about one mile added to the coastline in each sixty-year period.[1]

On this basis, the site of Shanghai would have been on the seacoast about 500 B.C., an empirical estimate which agrees with the record of Chinese history. All cities in the delta area east of the line of Sungchiang (map 5) for which there are adeqaute records were founded after the third century A.D.[2] Records of the Eastern Han dynasty (25 A.D. to 220 A.D.) speak of Kunshan, now 80 miles from the sea, as the seaport of Soochow in the second century A.D., but Shanghai has served as Soochow's port since about the fifth century A.D. Tsungming Island in the Yangtze estuary, according to the official gazetteer of the island, first emerged as a habitable sand spit in the tenth century A.D. By the thirteenth century it was sufficiently densely populated to be made a separate *hsien* (county), and at present measures approximately 43 by 8 miles.[3]

Building and Drainage

The material on which Shanghai rests is thus totally unconsolidated and presents serious problems for building. An average vertical section shows silt from the surface to about 20 feet, sand to 300 feet, and gravel mixed with sand and silt to about 1000 feet, where some consolidated conglomerate is reached. The water table lies between five and eight feet below the surface of the ground.[4] It may be assumed that before the draining and filling done by the foreigners since 1843, the water table was considerably higher, and that even before 1843 the canals dug by the Chinese provided enough drainage to keep the water table lower than it would otherwise have been considering the soil and elevation of the site.

Foreigners were discouraged to find in 1875 when a bridge was built across the mouth of Soochow Creek * that one blow from the small pile driver employed buried the pilings out of sight in the

* "Soochow Creek" is the name given by foreign residents to the Woosung Chiang, originally a much larger stream, which drains into the Whangpoo at Shanghai and connects the city with Soochow, some sixty miles inland. In the interests of clarity and consistency it will hereinafter be referred to as Soochow Creek, the name by which it has most generally been known in Shanghai itself.

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NINE

How the City is Fed

Agriculture and Transport in the Delta

The portion of the Yangtze delta which we have called the fertile triangle (Chapter Four) stands out in dramatic relief as one of the richest agricultural areas in China. Maps 7, 10, and 11 show its place in the pattern of agricultural occupance and rice production. Shanghai lies at the apex of this largest area of high-fertility soil in China with adequate rainfall, and indeed so large a city could have developed nowhere else before the industrial revolution. With railway development still in its infancy in China, Shanghai has been able to maintain itself as a city of nearly four millions because it is located in what is in effect a huge truck garden.

The soil of the delta is of course alluvium, and its correspondingly high fertility is implemented by its fortunate median position between the semi-arid north and the humid south. Between Hangchow on the south and the Huai River on the north, average annual rainfall decreases from 58 inches to 34 inches. South of the line of the Huai River, leaching has removed much of the original lime content of the soils, but the prevailing gentle quality of the rains in the delta area and their relatively even distribution over the year * has prevented removal of all the lime. The line of the Huai roughly marks the division between the wheat-kaoliang-millet crop economy of the semi-arid north and the rice-tea-silk complex of the humid south, although the two major agricultural patterns overlap in the delta to some extent. Below Hangchow, rainfall increases sharply, and most of the soils of south China are thoroughly leached.

The fertile triangle thus avoids both the inadequate rainfall of

* Rainfall is concentrated from March through August, but no month has more than nine inches and no month less than two.

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the areas immediately north and the leaching of the areas immediately south. It shares with most of south China however a soil which has a high clay content and is thus suitable for wet-rice cultivation in paddies. Of equal importance for the soil with the amount, distribution, and nature of the rainfall is the continual renewal of the alluvium by the Yangtze and its tributaries. While in the absence of frequent floods covering the whole of the area this renewal cannot keep pace with the soil exhaustion attendant on 2,000 years of farming, the material which the rivers bring down and deposit is a highly fertile mixture of well-varied origin containing in particular considerable calcium.[1]

Rainfall over the fertile triangle as a whole averages about 43 inches annually, and falls largely in gentle showers. The peak in late April, May, and June is especially favorable to agriculture, coming as it does during the planting season for most crops in this area and continuing through the first important weeks of early growth. These are the so-called plum rains (*pai-yü*), accompanying weak cyclonic storms whose effect is somewhat lessened by the counter influence of the monsoon wind system of east Asia. The growing season is long, averaging 287 days at Shanghai between killing frosts, 291 at Nanking, and 307 at Hangchow.

Relief forms almost no obstacle to cultivation. For the triangle as a whole, about 80 per cent of the total land area is cultivated (eliminating the area covered by lakes), the highest figure for an area of comparable size in China, according to J. L. Buck's figures.* The

* J. L. Buck, *Land Utilization in China* (1937). This is a highly statistical study, whose limitations are obvious in dealing with a largely illiterate peasant society where accurate or complete statistical information is unobtainable. Buck's figures have often been used too literally, but since they are virtually the only ones available on a national basis they may be used to advantage if it is realized that despite their detail they are no more than approximations, arrived at by Western methods whose applicability to the traditional Chinese society is questionable. Their safest use is as estimates of orders of magnitude. Subsequent citations here from Buck's work should be read with these considerations in mind.

Buck's figures have the advantage of considerable regional detail. Since the discussion of food production and marketing here is largely limited to the fertile triangle, Buck's statistics are more readily usable than others gathered or presented on a provincial basis. However, reference should be made to some of these more general studies by Chinese, of agriculture and of rice production, which bear on the problems treated here, and which I have used in a general way in addition